Rationale for Concurrence by Maine Center for Disease Control and Prevention on the Designation of Bisphenol A as a Priority Chemical

Background

Under 38 MRSA §1694, the Commissioner of the Maine Department of Environmental Protection (ME-DEP) may designate a chemical of *high concern* as a *priority chemical* if the Commissioner finds any of the following:

A. The chemical has been found through biomonitoring to be present in human blood, including umbilical cord blood, breast milk, urine or other bodily tissues or fluids;

B. The chemical has been found through sampling and analysis to be present in household dust, indoor air, drinking water or elsewhere in the home environment;

C. The chemical has been found through monitoring to be present in fish, wildlife or the natural environment;

D. The chemical is present in a consumer product used or present in the home;

E. The chemical has been identified as a high production volume chemical by the federal Environmental Protection Agency; or

F. The sale or use of the chemical or a product containing the chemical has been banned in another state within the United States.

Once a chemical is listed as a priority chemical, the ME-DEP may require disclosure of information about the presence of the chemical in children's products (§1695) and prohibit sales of children's products including this chemical (§1696).

38 MRSA §1694 requires that the designation of a chemical as a *priority* chemical be made in concurrence with the Department of Health and Human Services, Maine Center for Disease Control and Prevention (ME-CDC).

The ME-DEP has proposed to list the chemical *Bisphenol A* as a priority chemical. The Agency has requested that ME-CDC review the Department's draft *Basis Satement for Chapter 882 Designation of Bisphenol A as a Priority Chemical and Sales Prohibition of Certain Consumer Products Containing BPA and Safer Chemical Program Support Document for the Designation of a Priority Chemical of Bisphenol A* (referred to as *BPA Basis Statement*). [1]

ME-CDC concurs that it is appropriate to designate Bisphenol A as a priority chemical under 38 §1694. In reaching its decision, ME-CDC performed its own review of the scientific literature

[1] Draft Basis Statement for Chapter 882 Designation of Bisphenol A as a Priority Chemical and Sales Prohibition of Certain Consumer Products Containing BPA and Safer Chemicals Program Support Document for the Designation as a Priority Chemical of Bisphenol A. Maine Department of Environmental Protection, Bureau of Remediation and Waste Management, 21 April, 2010.

relevant to findings under 38 MRSA §1694 (A), (B), and (C) - which are the three content areas within the expertise of the ME-CDC. ME-CDC also reviewed the evidence that Bisphenol A is a developmental toxicant and endocrine disruptor, one of the three criteria for designating a chemical of *high concern.* Since chemicals may be classified as of *high concern* for reasons other than human health hazard (i.e., persistent and bioaccumulative), ME-CDC viewed it as appropriate to brief review the toxicity data as well.

Evidence that BPA may be classified as an endocrine disruptor and developmental toxicant

There is no controversy that BPA is an endocrine disruptor, acting by inhibiting the effects of estrogen, a vital reproductive and developmental hormone. High doses of BPA in animals have been documented to affect a variety of reproductive and developmental endpoints. Recent discussion has centered on the validity and reproducibility of low-dose, environmentally relevant doses of BPA. The initial concern revolved around the fact that high doses of BPA were necessary to produce effects on relatively insensitive endpoints typically used in screening studies. However, there is increasing recognition that chemicals that affect hormonal control, including BPA, may affect more sensitive endpoints that assess mechanistic pathways at very low doses. In fact, hormonally active compounds may have opposite effects at high and low doses, and effects may be observed at low doses but not high (Myers *et al*., 2009). Additionally, it has recently been recognized that BPA interferes with receptors other than the classic estrogen receptor, to which it weakly binds (NTP, 2008; Richter *et al*., 2007).

The current consensus of most scientists, as well as U.S. and international governmental agencies, is that there is sufficient evidence that BPA produces adverse effects at environmentally relevant exposures. Well over 100 studies have documented adverse effects on growth, brain development, behavior, early onset of puberty, changes in sex hormones, male fertility, and immune function as a result of exposure to environmentally relevant doses during the prenatal or postnatal period in animal models (vom Saal and Hughes, 2005; Chapel Hill bisphenol A consensus panel, 2007). In September of 2008 the National Toxicology Program of the U.S. Department of Health and Human Services issued a report documenting the toxic effects of BPA and the evidence for exposure of the U.S. population (NTP, 2008). The NTP concluded that there was "*some concern* for effects on the brain, behavior, and prostate gland in fetuses, infants, and children at current human exposures to bisphenol A." Note that this level of concern requires documentation of adverse effects in numerous studies for each outcome, as well as concordance between the exposures or body burdens of BPA in the animal studies compared to those in humans environmentally exposed. In 2010, after initially dismissing concerns about exposure of the U.S. population to BPA, FDA concurred with the NTP report (FDA, 2010).

Since the NTP report in 2008, evidence for low-dose effects has continued to mount (Talsness *et al*., 2009). Effects of low doses of BPA following developmental exposure in animal models include changes in reproductive function (Adewale *et al*., 2009); behavior (Palanza *et al*., 2008; Tian *et al*., 2010), including sex-specific behavior (Patisaul and Polston, 2008); brain structure (Zhou *et al*., 2009); development of asthma (Midoro-Horiuti *et al*., 2010); and increased body weight and production of fat cells (Rubin and Soto, 2009; Somm *et al*., 2009). Recent studies in the general human population found associations between BPA and heart disease and diabetes in adults (Lang *et al*., 2008; Melzer *et al*., 2010). An association was also observed between

prenatal exposure to BPA, as measured by maternal urine levels, and externalizing behavior (hyperactivity, aggression) in the children at two years of age (Braun *et al*., 2009). This is the only study to date on the effects of environmental exposure to BPA during development in humans. A study using human placental cells found toxic effects at low levels (Benachour and Aris, 2009).

Evidence that BPA is present in human tissue (38 MRSA §1694.A)

BPA is found in blood and urine of individuals in the general population of all industrialized countries studied, including blood of infants and children, umbilical cord blood, amniotic fluid, and placental tissue (NTP, 2008; EWG, 2010). Vandenberg *et al*. (2010) reviewed over 80 published human biomonitoring studies, which included thousands of individuals. In most studies, BPA was detected in 75-100% of individuals. An ongoing study by the U.S. CDC, which collects data representative of the U.S. population, found BPA in 93% of all individuals, with BPA levels in children 6-11 years of age almost twice as high as adults (younger children were not sampled) (Calafat *et al*., 2008). Since BPA is cleared from the body relatively rapidly, the fact that it is present in most people suggests ongoing exposure (NTP, 2007).

Evidence for potential ingestion of BPA by infants and children (38 MRSA §1694.B)

BPA may be a constituent of polycarbonate bottles, including baby bottles and water bottles. BPA may also be present in food-can liners. BPA migrates from baby bottles into water (Cao and Corriveau, 2008). Greater concentrations migrate into hot water than cold (Le *et al*., 2008; Maragou *et al*., 2008; Ehlert *et al*., 2008). Concentrations in 100 ^{o}C water were sufficient to produce effects in *in vitro* assays of estrogenic activity and neurotoxicity (Le *et al*., 2008). BPA has been found in canned liquid infant formula from a number of producers (Cao *et al*., 2008) as well as other canned foods (Consumer Reports, 2009) and soft drinks (Health Canada, 2009). In a study in college students, one week of drinking all cold liquids from polycarbonate bottles increased urine concentrations of BPA by two-thirds (Carwile *et al*., 2009).

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